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(the ravine). On the steppe, *Sanguisorba officinalis* transpired more rapidly than *Clematis integrifolia*, 3.3 gm. against 1.2 gm. In the ravine the reverse was true, 1.7 gm. against 0.7 gm. Similar results were found for *Phlomis pungens* and *Ajuga Laxmanni*, with the former transpiring more rapidly in the steppe and less rapidly in the ravine. These facts are explained by the rapid closure of the stomates of *Sanguisorba* and *Ajuga* in the exposed position, and the slow closure in the other forms. In another experiment, two marked xerophytes, *Aster villosa* and *Veronica incana*, showed much higher transpiration than two evident mesophytes, *Aristolochia clematitis* and *Sanguisorba officinalis*. The losses in these forms were respectively 43.3, 15, 11.3, and 6.4 gm. These results are explained by the stomates being closed in the mesophytes and open in the xerophytes.

It was rather a common thing to find higher transpiration in a given mesophyte in the ravine than on the steppe, owing to the stomatal closure in the latter place. In *Ajuga Laxmanni*, there were 10.5 gm. on the steppe against 26.2 gm. in the ravine; in *Centaurea orientalis*, 17.6 gm. against 31.5 gm. In an experiment with *Helianthus annuus*, *Pisum sativum*, *Vicia Faba*, and *Polygonum fagopyrum* placed in a series of positions where the evaporation power of the air graded from a low value to a high, the transpiration rose with the evaporation power of the air up to a certain height, then it fell enormously with the rise of the evaporation power of the air. The break was the point at which stomatal closure was induced. When the author started with various mesophytes and xerophytes, all with the stomates open, and placed them in conditions where the evaporation power of the air was rather high and rising rapidly, as time elapsed the mesophytes showed rapid transpiration, rising rapidly with the evaporation power of the air for two hours or so, followed by a rapid fall. In this case there is a high and sharp pointed curve. The xerophytes showed slower initial transpiration, a far slighter rise with the evaporation power of the air, and no such marked fall. In this case, the curve is flat, with no very high or sharp point. ILJIN believes the two types of curves represent mesophytism on the one hand and adaptation for xerophytism on the other. The xerophyte can protect itself against excessive transpiration in exposed positions without curtailing extremely the CO_2 necessary for carbon assimilation by rapid or extreme stomatal closure. This work indicates the great importance of stomatal variation in regulating transpiration, especially in mesophytes, a conclusion quite in contrast with that of LLOYD.—WILLIAM CROCKER.

Alpine plant-geography.—RYDBERG,[16] in the first three of a series of articles on the phytogeography of the Rocky Mountain region, has discussed the alpine zone, its environmental conditions, geographic floristics, and plant communities. The first article characterizes the alpine zone as the area below perpetual snow and above the forest line, including for convenience the transitional area in which subalpine *Krummholz* and scattered trees alternate with alpine grassland. A number of the factors which together determine the position of timber line are discussed. The writer's opinion that deficiency of rainfall, or of precipitation in proper form, is an important factor preventing tree growth in the alpine zone may be questioned. In the table of precipitation for various points in Colorado given by ROBBINS (BOT. GAZ. 49:260. 1910), Pike's Peak has the highest mean annual rainfall listed, 28.65 inches; July and August, when alpine plants are most active, are the rainiest months. The influence of mountain masses is given by RYDBERG as tending to moderate conditions, so as to allow trees to extend to higher elevations. This effect may not be so general, for some botanists believe the presence of surrounding mountain masses have the opposite influence in some cases. Few observers would agree with RYDBERG in classing Long's Peak, in the Front Range, with Pike's Peak and Sierra Blanca as isolated mountains. The question may be regarded as still open.

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[16] RYDBERG, P. A., Phytogeographical notes on the Rocky Mountain region. I. Alpine region; II. Origin of the alpine flora; III. Formations in the alpine zone. Bull. Torr. Bot. Club **40**:677–686. 1913; **41**:89–103, 459–474. 1914.

In the second article the regions in which the alpine species have probably originated (perhaps it would be better to say the geographic sources from which they have probably been derived) are discussed, with lists for each region and lists of species common to two or more regions. The author is of the generally prevalent opinion that most of our alpine plants reached their present scattered stations during glacial times, when the circumpolar arctic-alpine flora was practically continuous over much lower latitudes and altitudes than at present. More than one-third of the species are restricted to North America. About 100 species from the subalpine zone extend higher than the forest line, and the purely alpine plants number about 250 species.

The third article is an account of the associations. The communities are called formations (in the specific sense in which the term association is generally used); they are based on habitat as determined by topography. They are: (1) rock-slide formation of rock-slides and rock-fields; (2) the generally distributed mountain crest formation of areas thinly covered with gravelly soil (apparently this corresponds to the dry meadow of COOPER, BOT. GAZ. 45: 324. 1908); (3) mountain seep formation; (4) alpine meadow; (5) alpine bog; (6) alpine lake or pond; (7) cliff formation; (8) snowdrift formation. It is perhaps a question whether some of the associations might not better have been characterized and named from the vegetation itself rather than from the habitat. The lists of species are full; those extending into the lower mountains are distinguished, and also those characteristic in, or confined to, the northern or southern parts of the Rocky Mountain region. Hardly any information is given to indicate which species are most frequent, abundant, or characteristic in particular associations. The alpine zone is really well known to very few botanists, and articles dealing with its vegetation are not numerous, thus giving the present writing so much the greater value.—ARTHUR G. VESTAL.